Q1. What is "Hydrological Cycle"? Now-a-days there is general discussion that Hydrological Cycle has been disturbed. Is this a myth or reality? Briefly

Hydrological Cycle: is the continuous movement of the waters from the earth to the atmosphere and back to earth. In simple words, the water is evaporated form the earth's ocean with the help of sun energy and forms clouds in the atmosphere, when condenses it precipitate water back to land with the help of gravitational force. In land it join streams and rivers and return back to the ocean and the cycle continues.

Every time humans interrupt the natural water cycle there will be an effect. The changes are global and significant. As human we have big impact on the water. Different countries use different amounts of water, but we all tend to use them in the same ways, and some of these actions can impact on the water cycle generating hydroelectricity, irrigation, deforestation and the greenhouse effect, as well as motor vehicles use and animal farming.

Irrigation: The problem with irrigation is that it removes water from its natural source and often causes leaching and run off where it is used. This removal of nutrients results in farmers using more fertilizers to keep their pastures productive while the water ways become polluted.

Deforestation: The removal of trees is having a major impact on the water cycle. Normally trees release water vapor when they do transpiration, producing localized humidity. This water vapor then evaporates into the atmosphere where it accumulates before precipitation back to the Earth as rain, sleet or snow. With deforestation, there is less water to be evaporated into the atmosphere and subsequently less rain

Greenhouse effect: Human activity such as the burning of fossil fuels has an effect on the overall increase of the Earth's temperature. Raising the Earth's temperature may mean that there is an increase of evaporation, melting of ice or other process of the water cycle that adversely affect the climate on Earth.

Climate change increases our risks of both heavy rains and extreme droughts. As global temperature have steadily increase, it is directly affected things like water vapor concentrations, clouds, precipitation patterns, and stream flow patterns, which are all related to the water cycle.

As runoff increases, infiltration of water back into the soil, decreases. This also prevents the replenishing of groundwater. Sediment can cloud the water and make it difficult to aquatic plants to grow and can destroy aquatic habitats. Excess nutrients can cause algae blooms. When they die, they decompose in a process that robs the water of its oxygen

The above mentioned findings deduced that the disturbance in the hydrological cycle is indeed a reality and engineering fraternity needs to convey a message to the world that they should recognize the dimensions and implications related to disturbance of

hydrological cycle and find solutions to global change.

Q2. Briefly describe "Ground water Sustainability"? How can "Rainwater Harvesting" be linked to ground water sustainability?

Ground water is simply water below the Earth's surface. Traditionally further restricted to refer to water below the water table. Water table is the dynamic subsurface horizon beneath which all pores are filled with water at a pressure greater than atmosphere pressure.

Sustainability is about that respects the needs of the society it serves, a society that lives within its environmental means. An Environment which is maintained in as natural a state as possible.

The New Castle definition for sustainability "Enough, for all,
forever" Enough: implies economic sufficiency (but not excess)
For all: must understood to evoke both social justice and the needs of non-human beings Forever: Demands recognition of the finite nature of natural resource implies pursuit of inter- generation justice.

Groundwater sustainability is the development and use of groundwater resources to meet current and future beneficial uses without causing unacceptable environmental or socioeconomic consequences.

Rainwater harvesting and **Ground water Sustainability**: A significant fraction of the world's population already lacks sufficient fresh water and will undoubtedly experience water shortages through the coming decades. Countries located in arid region of the world where water scarcity is a major issue needs to find other alternative source of water supply. This limited supply can deplete further or being made unusable by over utilization and population. Therefore the need of the hour is water conservation what is referred to as water harvesting. Water harvesting encompasses different method of conserving and collecting rain water. One such method is Rain Water Harvesting and another is recharging ground water. Rain water harvesting involves collecting the rainwater directly or recharging it to improve ground water storage and how does it benefits us , it raises the ground water level, checks rainwater flow which in turn prevents soil erosion. Prevents rainwater pollution and helps meet water demands during dry season. And all of this can be accomplished nothing more than house roof tops to collect the water and small PVC pipes to channelize the water into the underground pits and sumps.

Recharging ground water is the modern version of rainwater harvesting. In this pits, trenches and dug wells are constructed to collect water. The collected water then feeds in and raises the level of ground water.

With depleting groundwater levels and fluctuating climate conditions, RWH can go a long way to help to tackle these effects. Capturing the rainwater can help recharge local aquifers, reduce urban flooding and most importantly ensure water availability in water-scare zones.

Q3. What are the "Quality Parameters" to be considered in designing water supply system?

The following are a list of Quality Parameters that are important in the design-flow water supply system.

Maximum Pressure Limits: The maximum overpressure (sometimes called the maximum permissible pressure) is the maximum pressure to which the supply system may be subjected without damaging the system. Do not operate this device at pressures exceeding the specified maximum working pressure. This can be attained by the closed state of the taps and valves. All out head cutoff points ought to be utilized to play out the estimations for the pipework. . Toward the start of the plan this situation is utilized to have the option to situate any break-pressure tanks that may be required.

Safe Yield: Safe yield is the maximum quantity of water which can be guaranteed during a critical period. There should be an equilibrium between demand and supply at any point. It is essential to not draw more than this supply from the system anytime. If this occurs then spring boxes and/or break pressure tanks will run dry and air will enter the system.

Negative or Low Pressure Head: In the event when the pressure head becomes negative in the system it gives rise to siphon impact that is it suck water into the system making ground water polluted. Moreover it creates air blocks. Recommended value for the pressure head is minimum of 10m.

Velocity Limits: The design of the water piping system is greatly influenced by the selected flow velocities. If the velocity is rapid it will create disintegration in the system due to suspended particles. However if the velocity is low the particles will settle in the pipes and will cause clogging.

Natural Flow: Natural Flow due to gravitation should be permitted keeping close consideration so that it does not violate the velocity lime and safe yield limit.

Residual Head: Residual pressure is pressure available at the end of a pipe run for a given flow rate. The residual head at a tap stand or valve is significant. If it's too high it will cause erosion of the valve and in the event if it excessively low then the flow will be minimal. The remaining head Air-blocks: Air blocks occurs when there is a elevation difference between the source and the collecting tank. Energy dissipates when air blocks are compressed resulting in minimal to no flow.

Economical: one the important variable of the design system is that it should be economical.